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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,311	09/26/2003	Adrianne K. Tipton	NOVLP075/NVLS-000820	4463

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EXAMINER	
COLEMAN, WILLIAM D	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 12/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/672,311	TIPTON ET AL.	
	Examiner	Art Unit	
	W. David Coleman	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22 and 24-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21,24-30 and 32-39* is/are rejected.

7)☒ Claim(s) *22 and 31* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *08/05; 10/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 17, 2005 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-21, 24-30 and 32-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Birnbaum et al., U.S. Patent 6,548,113 B1 in view of Gallagher et al., U.S. Patent Application Publication No.: US2002/0123240 A1.

Birnbaum discloses a semiconductor process substantially as claimed. See FIGS. 1A-3B, where Birnbaum teaches the following limitations.

4. Pertaining to claim 1, Birnbaum teaches a method of preparing a porous low-k dielectric material on a substrate, the method comprising:

forming a precursor film on the substrate, the precursor film comprising a porogen and a structure former; and

exposing the porous low-k dielectric material to a silanol capping agent and annealing the porous low-k dielectric material (see table 1, where the dielectric film is heat treated which is the same as annealing). However, Birnbaum fails to teach exposing the precursor film to ultraviolet radiation to facilitate removing the porogen from the precursor film and thereby create voids within the dielectric material to form the porous low-k dielectric material. Lukas teaches exposing the precursor film to ultraviolet radiation to facilitate removing the porogen from the precursor film and thereby create voids within the dielectric material to form the low-k dielectric material (see FIG. 1a-1c of Lukas). In view of Lukas, it would have been obvious to one of ordinary skill in the art to expose the precursor film to ultraviolet radiation for selective removal of the pore-forming phase [0064].

5. Pertaining to claim 2, Birnbaum in view of Lukas teaches the method of claim 1, wherein the precursor film comprises a porogen and a silicon-containing structure former.

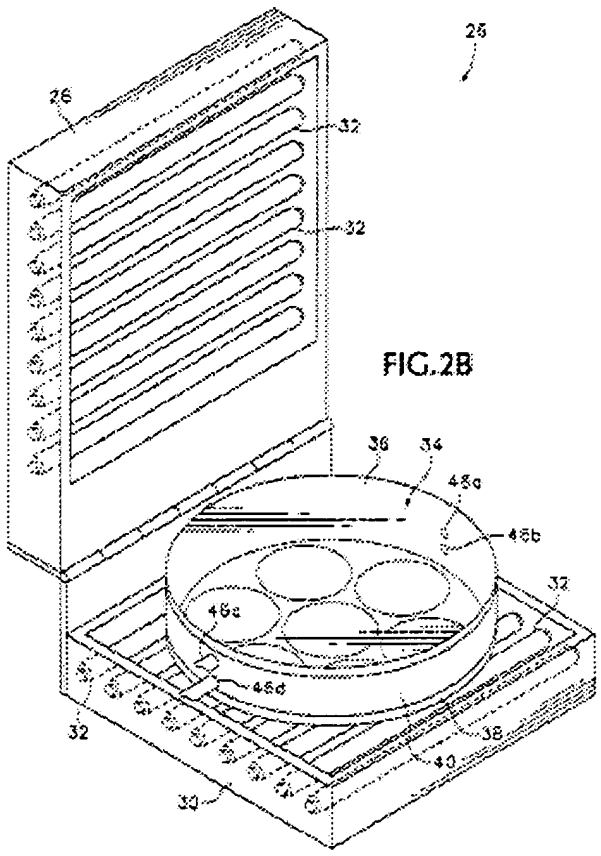


FIG.2B

6. Pertaining to claim 3, Birnbaum in view of Lukas teaches the method of claim 1, wherein the precursor film is formed by co-depositing the porogen with the structure former [0050].

7. Pertaining to claim 4, Birnbaum in view of Lukas teaches the method of claim 1, wherein the structure former is produced from at least one of a silane, an alkylsilane, an alkoxysilane and a siloxane [0030].

8. Pertaining to claim 5, Birnbaum in view of Lukas teaches the method of claim 4, wherein the structure former is produced from octamethylcyclotetrasiloxane (OMCTS), tetramethylcyclotetrasiloxane (TMCTS) or a combination thereof [0030].

9. Pertaining to claim 6, Birnbaum in view of Lukas teaches the method of claim 1, wherein the porogen comprises a polyfunctional cyclic non-aromatic compound [0019].

10. Pertaining to claim 7, Birnbaum in view of Lukas teaches the method of claim 6, wherein the polyfunctional cyclic non-aromatic compound is alpha-terpinene compound [0019].

11. Pertaining to claim 8, Birnbaum in view of Lukas teaches the method of claim 1, wherein the porogen has ordered structure (see FIG. 1c).

12. Pertaining to claim 9, Birnbaum in view of Lukas teaches the method of claim 8, wherein the porogen comprises a mesoporous structure formed from a block copolymer [0047].

13. Pertaining to claim 10, Birnbaum in view of Lukas teaches the method of claim 1, wherein the porogen and structure former exist in one precursor molecule [0051].

14. Pertaining to claim 11, Birnbaum in view of Lukas teaches the method of claim 10, wherein the compound is an organic silane [0030].

15. Pertaining to claim 12, Birnbaum in view of Lukas teaches the method of claim 10 wherein the compound is di-tert-butyl-sliane silane [0030]

16. Pertaining to claim 13, Birnbaum in view of Lukas teaches the method of claim 1, wherein the precursor film is formed by a chemical vapor deposition process [0044].

17. Pertaining to claim 14, Birnbaum in view of Lukas teaches the method of claim 1, wherein the precursor film is formed by a spin-on technique [0032].

18. Pertaining to claim 15, Birnbaum in view of Lukas teaches the method of claim 1, wherein exposing the precursor film to ultraviolet radiation takes place in an inert environment.

19. Pertaining to claim 16, Birnbaum in view of Lukas teaches the method of claim 15, wherein the ultraviolet radiation comprises light with a wavelength at or near an absorption peak of the porogen.

20. Pertaining to claim 17, Birnbaum in view of Lukas teaches the method of claim 15, wherein the inert environment comprises a gas selected from the group consisting of nitrogen, argon, helium and hydrogen.

21. Pertaining to claim 18, Birnbaum in view of Lukas teaches the method of claim 15, wherein the inert environment comprises vacuum conditions.

22. Pertaining to claim 19, Birnbaum in view of Lukas teaches the method of claim 1, wherein exposing the precursor film to ultraviolet radiation takes place in the presence of oxygen.

23. Pertaining to claim 20, Birnbaum in view of Lukas teaches the method of claim 19, wherein the ultraviolet radiation comprises light having a wavelength that produces at least one of ozone and oxygen radicals.

24. Pertaining to claim 21, Birnbaum in view of Lukas teaches the method of claim 1, wherein the substrate temperature during exposure to ultraviolet radiation ranges between about 25 and 450 degrees Celsius.

25. Pertaining to claim 24, Birnbaum in view of Lukas teaches the method of claim 23, wherein the silanol capping agent is selected from the group consisting of disilazanes, chlorosilanes, aldehydes, and combinations thereof.

26. Pertaining to claim 25, Birnbaum in view of Lukas teaches the method of claim 23, wherein the silanol capping agent is HMDS (please note that hexamethyldisilazane is abbreviated HMDS).

27. Pertaining to claim 26, Birnbaum in view of Lukas teaches a method of preparing a porous low-k dielectric material on a partially fabricated integrated circuit, the method comprising:

providing the partially fabricated integrated circuit to a process chamber, as partially fabricated integrated circuit is disclosed), wherein the partially fabricated integrated circuit comprises a precursor film having a porogen and a structure former;

and removing the volatile decomposition products from the precursor film, leaving the porous low-k dielectric material on the partially fabricated integrated circuit; and

exposing the porous low-k dielectric material to a silanol capping agent and annealing the porous low-k dielectric material (see the reasons in claim 1 above). However, Birnbaum fails to teach exposing the precursor film to ultraviolet radiation to facilitate removing the porogen from

the precursor film and thereby create voids within the dielectric material to form the porous low-k dielectric material. Lukas teaches exposing the precursor film to ultraviolet radiation to facilitate removing the porogen from the precursor film and thereby create voids within the dielectric material to form the low-k dielectric material (see FIG. 1a-1c of Lukas). In view of Lukas, it would have been obvious to one of ordinary skill in the art to expose the precursor film to ultraviolet radiation for selective removal of the pore-forming phase [0064] (as applied to claim 1 above).

28. Pertaining to claim 27, the combined teachings teaches the method of claim 26, wherein the ultraviolet radiation comprises wavelengths ranging between about 156 and 500 nn (it is well known that ultraviolet wavelength fall within the claimed range).

29. Pertaining to claim 28, the combined teachings teaches the method of claim 26, wherein the inert environment comprises an inert gas [0062].

30. Pertaining to claim 29, the combined teachings teaches the method of claim 28, wherein inert gas is at least one of nitrogen, argon, helium or hydrogen gas [0062].

31. Pertaining to claim 30, the combined teachings teaches the method of claim 26;, wherein the inert environment comprises vacuum conditions.

32. Pertaining to claim 32, the combined teachings teaches a method of preparing a porous low-k dielectric material on a partially fabricated integrated circuit, the method comprising: providing the partially fabricated integrated circuit to a process chamber, wherein the partially fabricated integrated circuit comprises a precursor film having a porogen and a structure former; and exposing the partially fabricated integrated circuit to ultraviolet radiation in the presence of oxygen to produce oxidizing conditions in which the porogen is oxidized to produce porogen oxidation products, which are removed from the precursor film, leaving the porous low-k dielectric material on the partially fabricated integrated circuit.

33. Pertaining to claim 33, the combined teachings teaches the method of claim 32, wherein the ultraviolet radiation directly interacts with the porogen to produce volatile decomposition products, thereby facilitating removal of the porogen from the precursor film (as described above).

34. Pertaining to claim 34, the combined teachings teaches the method of claim 32, wherein the oxidizing conditions comprise at least one of ozone and oxygen radicals [0062].

35. Pertaining to claim 35, the combined teachings teaches the method of claim 32, wherein the ultraviolet radiation comprises light at a wavelength that produces at least one of ozone and oxygen radicals (as described above).

36. Pertaining to claim 36, the combined teachings teaches the method of claim 35, wherein the ultraviolet radiation comprises wavelengths ranging between about 156 and 500 nm (as applied to the rejection of claim 27).

37. Pertaining to claim 37, the combined teachings teaches the method the method of claim 32, further comprising exposing the porous low-k dielectric material to a dehydroxylation agent.

38. Pertaining to claim 38, the combined teachings teaches the method of claim 32, wherein the silanol coapping agent is selected from the group consisting of disilazanes, chlorosilanes, aldehydes, and combinations thereof.

39. Pertaining to claim 39 the combined teachings teaches the method of claim 32, wherein the silanol capping agent is HMDS.

Objections

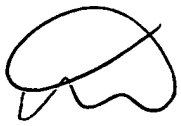
40. Claims 22 and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

41. Any inquiry concerning this communication or earlier communications from the examiner should be directed to W. David Coleman whose telephone number is 571-272-1856. The examiner can normally be reached on Monday-Friday 9:00 AM - 5:30 PM.

42. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

43. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



W. David Coleman
Primary Examiner
Art Unit 2823

WDC